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THE IMPACT OF TAPAYAN COMMUNAL IRRIGATION SYSTEM

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I. INTRODUCTION

Irrigation development has become a major component of agricultural modernization in Central Mindanao. Irrigation projects represent a critical infrastructure for agricultural development in this rice-growing region. Improved water supply control is recognized as an important factor in the achievement of the full potential of modern rice varieties and as a very promising means of increasing food production.

The National Irrigation Administration (NIA) XII, which is the lead agency for irrigation development, plans to irrigate an additional 167,743 hectares and improve irrigation on 84,743 hectares during the next ten-year period. The prospective expansion in irrigated land will contribute significantly to the agricultural development and economic growth of the region.

The NIA estimates that its six national systems irrigate 30,260 hectares while 68 communal systems irrigate an additional 45,864 hectares. In addition, private communal irrigation systems cover 8,618 hectares.

II. PROJECT BACKGROUND

The transformation of the Tapayan rural community into a more productive, modern and integrated barangay has been a major priority of the people for the past four decades. The rural people's concern has been to transform indigenous small-scale resources as well as to introduce more modern techniques and technologies in

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the area. The development of the Tapayan Communal Irrigation System (TCIS) has been a part of this endeavor.

The TCIS originated as purely a people's project. The original irrigation canal and dam were made out of indigenous materials and were constructed by the farmers utilizing their own manpower and resources.

The Tapayan Communal Irrigation System

The Tapayan Communal Irrigation System is situated in Barranggay Tapayan in Sultan Kudarat, Maguindanao. Approximately 13 kilometers from Cotabato City, it is geographically bounded by Barangay Tambo on the north and Balut Lake on the east. The total potential and irrigable area under the jurisdiction of Barangay Tapayan is about 400 hectares which is traversed by the National road going to the Polloc Port in Parang, Maguindanao.

Tapayan is rich in water resources. Aside from Lake Balut in the east, the area is surrounded by rivers — Rio Grande on the west and Simuay river on the northeast. However, despite available water resources, irrigation has been a problem ever since Ilocano migrants settled in Tapayan in the 1940's. Even until the 1950's only those farmers near the lake used its water to irrigate their farms.

It was not until 1960 that an effort to develop an irrigation system emerged. The farmers organized themselves into an association for that purpose and began constructing an irrigation dam. They used coconut trunks and bamboos patched with stones and mud in constructing the dam. The original canal was expanded from one to two meters wide. At one time, a surveyor from the PACD (Presidential Assistant on Community Development) office visited the dam built by the farmers. The president of the farmers' association asked the surveyor for possible assistance from his office. When the survey was conducted and completed, the PACD contributed some 60 bags of cement and iron bars which were just enough to construct the headgate of the dam. Unfortunately, a big flood struck in 1962 and washed out the dam.

Sometime in 1972, the peace and order condition in the Cotabato area deteriorated and Tapayan was declared critical by military authorities. The farmers abandoned the area. In 1974, peace and order was restored, and those farmers who fled returned and resumed their farming. In January 1975, an irrigation engineer of the NIA Provincial Office in Cotabato City resurveyed the dam site

in Tapayan. When the feasibility study was completed, the association, as advised by the survey team, petitioned the NIA office for the construction of a gravity communal system in Tapayan.

On 27 January 1975, hydrographic studies and topographic surveys were officially conducted by the NIA survey team to pinpoint canal location and a diversion site, taking into consideration some suggestions of their guides who were association members. The results of the study were sent to the Regional Office of the NIA, which then prepared a design.

On 5 May 1975 construction of the project began, using NIA funds and with NIA staffers supervising the construction work. A total of 10 farmers were initially hired by the NIA at ₱11.00 a day. The laborers cleared the dam site and started gathering stones. They built a bodega for the storage of construction materials. On the fifteenth day, 12 additional member-farmers were hired at the same rate. The workers were divided into teams of 10 and rotated every fifteen days for over a month. In order to finish the construction of the dam at the earliest possible time, all the 52 association members were put to work daily and the construction of canals was done on a contract basis by a group of 60 nonmembers.

In June 1976, the association was registered with the Securities and Exchange Commission as the Tapayan-Tuka Communal Irrigation Association, Incorporated, to clothe it with a juridical personality (Agbon 1981). The Tuka farmers joined the association after the area was included in the estimate of the total irrigable land area by the TCIS. That brought the total membership of the association (which is responsible for operating and maintaining the project) to 169. Each farmer contributed labor to maintain the project. As members of the association, the farmers paid a membership fee of ₱2.00 and an annual fee of ₱5.00 each. An irrigation fee of ₱50.00 per hectare per cropping season was paid only by those members who availed themselves of the services of the system. The fee is used to cover operation and maintainance and an amortization charge toward the construction cost. The NIA formulated the constitution and by-laws and passed it on to the association.

On 15 December, 1976, the Communal Irrigation System was already nearing completion, with a net construction cost of ₱116,682.65. The farmers were subsidized on the capital outlay since 10 percent of the actual construction cost (estimated as NIA's contribution to the project) was deducted from the repayment obligation and no interest charge was collected. The net total construction cost

is payable in 25 years, at a yearly amortization of ₱5,543.51. The first payment of the amortization was made in December 1978.

III. REVIEW OF RELATED LITERATURE

This section reviews some of the existing literature on the impact of irrigation on the various areas of development concern. Although there have been a fair number of studies on the impact of irrigation, they deal mostly with areas of concern directly or most significantly affected by irrigation projects, namely, agricultural production and productivity, level and distribution of income, and employment. The following review is therefore limited to the abovementioned areas of concern.

Agbon (1981) in her study of the Tapayan Communal Irrigation System reported that, before the establishment of the irrigation system, the farmers' produce of palay was from 40 to 60 cavans per hectare and that their family incomes were not enough to support their families.

After the establishment of the irrigation system, the farmers' produce of palay increased to 90-100 cavans per hectare and their incomes increased. Consequently, their standard of living improved; they fared even better than ordinary government employees or public school teachers.

Dozina et al. (1976), in their study of the rehabilitation of the Cavite Communal Irrigation System, estimated how the average gross value added per farm in the system was divided among landlord, farm operators, and hired workers and compared how such income shares changed before (1972 dry season) and after (1974 dry season) the rehabilitation. They found that the income shares of landlords, farm operators, and hired laborers all increased in absolute terms by over 100 percent. However, the rate of change was the largest for hired laborers, followed by farm operators. As a result the relative share of income for hired labor increased by 18 percent but those for farm operators and landlords declined by 3 percent and 6 percent, respectively.

IV. HYPOTHESIZED IMPACT OF TAPAYAN COMMUNAL IRRIGATION SYSTEM

Several hypotheses on the impact of the Tapayan Communal

Irrigation System on specific concerns have been formulated as follows:

1. *Agricultural Production and Productivity.* It is hypothesized that the Tapayan Irrigation System will bring about increased agricultural production and productivity primarily through (a) an increased yield per hectare during both the wet and dry seasons through better water control, (b) higher cropping intensity, and (c) increased physical land cultivation.

2. *Income Growth.* Through increased agricultural production and productivity, it is expected that the Tapayan Irrigation System will result in an increased absolute income of farm households regardless of tenure, including the landless laborers.

3. *Distribution of Income.* It is hypothesized that within the influence area of Tapayan, the Irrigation System will lead to improved distribution of income. That means that small farmers and landless laborers will benefit relatively more from the irrigation system.

4. *Employment.* It is hypothesized that the Tapayan Irrigation System will increase both farm and nonfarm employment through (a) higher labor requirements of irrigated crops compared to non-irrigated crops, (b) increased labor utilization due to higher cropping intensity, and (c) higher off-farm employment due to the higher volume of agricultural output that is transported, procured and marketed.

V. METHODOLOGY OF RESEARCH

The following methods were used in an attempt to seek answers to the specific questions in order to analyze the impact of the communal irrigation system on specific concerns such as productivity, income and employment:

1. A review and analysis of the existing literature on impact study research;

2. An interview of respondents and a review of existing records describing the history of Tapayan;

3. A guided interview to enable the evaluator to gain a better understanding of the socioeconomic status of the farmers as beneficiaries of the Tapayan Communal Irrigation System.

Guided Interview

In adopting the guided interview technique of gathering data needed for the evaluation research, the following items were considered: schedule of interview subjects of the evaluation research, and conduct of interview.

1. Interview schedule. The schedule of interview in the project site was in two stages. First there was a conference with the Barangay Captain, the President and members of the Tapayan Communal Irrigation System Association where a briefing on the purpose of the evaluation research project was conducted. Second, an interview of farmer beneficiaries was conducted. The series of interviews conducted in the project areas lasted for about five days. Research assistants were hired as enumerators to facilitate the interview. These enumerators were Muslims who could speak the local dialect and thus facilitate the interview.

2. *Subjects of the research study.* The list of the farmer-members of the association who are the beneficiaries of the system was examined and a sampling of respondents was derived. A simple random technique was used. A total of forty-two farmer-beneficiary members were chosen from a total listing of 169 members of the association.

3. *Administration of the interview.* The interviews were conducted by the evaluator together with the enumerators in a conversational manner to allow the farmer-beneficiary respondents to talk freely. Most of the time, the evaluator made an introductory statement of his purpose and started the interview by encouraging the respondents to answer the questions freely. The respondents were interviewed either in their homes or on their farms.

Research Design

Since the Tapayan Communal Irrigation System is already in operation, some kind of summative evaluation was done. A post-test-design was employed. But without any comparison group, it was hard to measure the impact of the project, and the evaluator decided to do the measuring by comparing three different levels of water supply: high, medium, and low. The dry season period of 1981 was considered in this study, to be able to capture the three levels of water supply to palay farms.

In grouping the farms into three levels, one criterion used was the

distance of farms from the irrigation dam. One assumption made is that, during the dry season, farms which are farther away from the irrigation water source get less water supply, or that the nearer the farm to the irrigation water source, the higher is the water supply. Another assumption is that all farms in the areas are comparable in climate, soil, use of inputs and other technology except in the level of water supply during dry season period.

Specifically, the following analyses were used in the measurement of the impact of irrigation on specific concerns (Paris 1979, pp. 39-49).

A. *Agricultural Production and Productivity*

Specific data required include volume of production, hectarage, and quantity marketed and consumed by crop and season. The indicators used were expressed as an average or total for every category in the study area. Specifically, the impact indicators were derived as follows:

1. Yield per hectare (Y)

$$Y_{ij} = \frac{\sum_{k=1}^{n} Q_{ijk}}{\sum_{k=1}^{n} A_{ijk}}$$

where:

Y_{ij} = average yield per hectare of crop i, season j

Q_{ijk} = total farm production of crop i, season j, of farm $K(k=1, \ldots, n)$

A = area planted to crop i, season j, farm $K(k=1, \ldots, n)$

2. Total production (TP)

where: $TP_{ij} = Y_{ij} \cdot A_{ij}$

TP_{ij} = total production of crop i in season j

Y_{ij} = average yield of crop i in season j

A_{ij} = total area planted to crop i in season j

3. Value of Production (VP)

where: $VP_{ij} = TP_{ij} \cdot P_{ij}$

VP_{ij} = total value of production of crop i in season j

P_{ij} = average price of crop i in season j

4. Proportion of Marketed Surplus (QM)

$$QM = \frac{\sum_{k=1}^{n} (Q_{ijk} - C_{ijk} - U_{ijk})}{\sum_{k=1}^{n} Q_{ijk}}$$

where:

C_{ijk} = home consumption of crop i season j, farmer K

U_{ijk} = losses and other uses of crop i, season j, farmer K

B. *Employment (AI^w)*

The indicators used in evaluating the impact of irrigation on employment are as follows:

a. Number of persons employed per farm, per hectare, by type by season;
b. number of man-days utilized per farm per hectare by crop and by season.

The change in labor utilization due to irrigation per farm and per hectare is given by:

$$AI^w = K^w A (L^i - L^n)$$

where:

A = total land use

L^i = labor requirements per hectare for high-irrigated farm

L^n = labor requirements per hectare for low-irrigated farm

K^w = proportion of irrigated area to total area in the dry season

C. *Level of Income (NI)*

Increased farm income is a direct consequence of improved agri-

cultural production and productivity made possible by irrigation, assuming no significant decline in product price. The indicators used in evaluating the impact of irrigation on the level of incomes are as follows:

a. net farm income per hectare by crop, by season, and tenure status
b. total farm income by tenure status
c. average daily wage of hired workers

The net farm income of crop *i* (NI_i) is the return to the farmer for his capital, labor and management on a per farm and per hectare basis after paying operating expenses. It was computed as follows:

$$NI_i = \frac{TR_i - VC_i}{A_i}$$

where:

TR_i = total receipt or value of production of crop *i*
VC_i = variable costs on crop *i*
A_i = area planted to crop *i*

D. *Distribution of Income*

The indicators used in evaluating the impact of irrigation project on the distribution of income are as follows:

a) distribution of irrigation benefits by tenure status (landlord, tenants, owner-operator, and landless hired labor).

VI. RESULTS AND FINDINGS

Distances

Average critical distance of all farms from the irrigation dam was 1.40 kilometers (Table 1). All farms less than or one kilometer away from the irrigation dam were categorized as high-irrigated farms; those 1 to 2 kilometers away, medium-irrigated farms; and those 2 kilometers or more away, low-irrigated farms.

TABLE 1
CRITICAL DISTANCES FROM IRRIGATION DAM, 42 PALAY FARMS BARANGAY TAPAYAN, SULTAN KUDARAT, MAGUINDANAO, 1981

Irrigated	*No. of farms*	*Average distance (km.)*
Low	14	2.11
Medium	14	1.45
High	14	.64
Total or average	42	1.40

Tenure Status

Owner-operators represented 57 percent of the 42 palay farmers interviewed (Table 2). Sharetenants represented 33 percent while leaseholders represented 10 percent.

TABLE 2
TENURE STATUS, 42 PALAY FARMS, BARANGAY TAPAYAN SULTAN KUDARAT, MAGUINDANAO, 1981

Irrigated	*Tenure Status*			
	Owner operator	*Share tenant*	*Lesse-holder*	*Total*
Low	6	7	1	14
Medium	10	4	0	14
High	8	3	3	14
Total	24	14	4	42
Percent	(57)	(33)	(10)	(100)

The Farm

The average farm size for all farms was 1.83 hectares. Medium-irrigated farms had the largest size 1.99 hectares. High- and low-irrigated farms and 1.71 and 1.79 hectares, respectively.

Prices

The average price received for all farms was ₱1.17 per kilo or ₱58.27 per cavan. Low-irrigated farms received the highest- ₱1.18 per kilo or ₱58.75 per cavan. Medium- and high-irrigated farms received ₱1.17 and ₱1.16 per kilo or ₱58.27 and ₱57.50 per cavan, respectively.

Wages

The average labor wage for all farms was ₱10.37 per labor per day. High-irrigated farms had the highest- ₱11.00 per labor per day. Low- and medium-irrigated farms had ₱10.00 and ₱9.52 per labor per day, respectively.

Labor

Hired labor represented 77 percent of the total labor for all farms (Table 3). Family labor represented 23 percent. The total cost or value of labor for all farms averaged ₱3,259.84. High-irrigated farms had the highest total value of ₱3,473.43, or the equivalent of ₱2,031.26 per hectare. This was brought about by the highest labor utilization in the high-irrigated farms. Medium- and low-irrigated farms had totals of ₱3,429.60 and ₱2,876.49 per farm, respectively.

Disposition of palay

The average production of palay for all farms was 140 cavans (Table 4). The amount of palay sold represented 55 percent of the production. Thirteen percent and 12 percent went to harvesters and threshers, respectively. Nine percent was used for personal consumption while 8 percent went to the landlord. The remaining were either kept as seed or used for other purposes.

Impact on production and productivity

The number of cavans produced per farm averaged 139.6, equal to 76.3 cavans per hectare (Table 5). High-irrigated farms produced 87.7 cavans per hectare and the low-irrigated farms 68.7 cavans per hectare.

TABLE 3
SOURCES AND COST OF LABOR, 42 PALAY FARMS, BARANGAY TAPAYAN, SULTAN KUDARAT, MAGUINDANAO, 1981

Irrigation status		*Sources*		
		Hired	*Family*	*Total*
Low	Man-days per farm	122.9	37.7	160.6
	Percent of total	(77)	(23)	(100)
	Total cost or value (in pesos)*	2,201.25	675.24	2,876.49
Medium	Man-days per farm	143.8	37.3	181.1
	Percent of total	(79)	(21)	(100)
	Total cost or value (in pesos)*	(79)	706.37	3,429.60
High	Man-days per farm	131.8	43.4	175.2
	Percent of total	(76)	(24)	(100)
	Total cost of value (in pesos)*	2,613.00	860.43	3,473.43
Average	Man-days per farm	132.9	38.9	171.8
	Percent of total	(77)	(23)	(100)
	Total cost or value (in pesos)*	2,512.49	747.35	3,259.84

*Including noncash payment for harvester and thresher.

Impact on income

The total gross income for all farms averaged ₱8,135.65 per farm, equal to ₱4,445.71 per hectare (Table 6). High-irrigated farms have a total income of ₱5,050.58 per hectare; medium-irrigated farm, ₱4,285.33; and low-irrigated farms, ₱4,037.02.

The average expense for cash and noncash items for high-irrigated

TABLE 4
AVERAGE DISPOSITION OF PALAY, 42 PALAY FARMS BARANGAY TAPAYAN, SULTAN KUDARAT, MAGUINDANAO, 1981

Item	Irrigated			Average, all farms	Percent of total
	Low	Medium	High		
Production per farm (cavan)	123	146	150	140	100
Disposal:					
Landlord	15.4	7.1	10.7	11.1	8
Harvester	14.8	19.5	18.2	17.5	13
Thresher	14.6	18.8	18.1	17.2	12
Operator*					
Sold	60.9	82.4	84.8	76.0	55
Home use	12.1	12.9	14.1	13.0	9
Seed	2.9	3.3	3.1	3.1	2
Other**	2.3	1.6	1.2	1.7	1

*Includes full-owner and share-tenant.
**Includes pay in kind and/or given free.

TABLE 5
AVERAGE PRODUCTION AND YIELD, 42 PALAY FARMS BARANGAY TAPAYAN, SULTAN KUDARAT, MAGUINDANAO, 1981

Irrigated	Number of farms	Units	Average Yield	
			Per farm	Per hectare
Low	14	cavan*	123.0	68.7
Medium	14	cavan*	146.0	73.4
High	14	cavan*	150.0	87.7
Total or average	42	Cavan*	139.6	76.3

*Cavan of 50 kilos.

farms was ₱3,210.22 per hectare; for medium-irrigated farms, ₱2,707.13; and for low-irrigated farms, ₱2,996.89. The average for all farms was ₱2,957.71 per hectare. Net profit for all farms averaged ₱2,723.04 per farm or ₱1,488.00 per hectare. High-irrigated farms had a net profit of ₱1,889.96 per hectare. Medium- and low-irrigated farms had net profits of ₱1,578.20 and ₱1,040.12 per hectare, respectively.

TABLE 6
GROSS INCOME, EXPENSES AND NET PROFIT, 42 PALAY FARMS, BARANGAY TAPAYAN, SULTAN KUDARAT, MAGUINDANAO, 1981

Item	*Irrigation status*			*Average (all farms)*
	Low	*Medium*	*High*	
Income				
Cash				
Palay sold	3,577.87	4,826.17	4,960.80	4,428.52
Noncash				
Landlord	904.75	415.85	615.25	646.52
Harvester	869.50	1,142.12	1,046.50	1,020.16
Thresher	857.75	1,101.12	1,040.75	999.73
Seed	170.37	193.28	178.25	181.75
Home use	710.88	755.55	810.75	760.28
Others*	135.13	93.71	69.00	98.69
Total Income				
Per farm	7,226.25	8,527.80	8,721.30	8,135.65
Per hectare	4,037.01	4,285.33	5,100.18	4,445.71
Expenses				
Cash				
Hired labor	474.00	479.99	525.75	484.40
Seed	302.14	370.14	252.43	308.24
Fertilizer	587.71	562.07	638.18	595.99
Insecticides	392.36	299.86	277.36	323.19
Herbicides	115.14	127.43	79.71	107.43
Irrigation fee	50.71	89.07	84.11	74.63
Noncash				
Landlord	904.75	415.85	615.25	646.52

Table 6 (Continued)

Item	Irrigation status			Average (all farms)
	Low	Medium	High	
Harvester	869.50	1,142.12	1,046.50	1,020.16
Thresher	857.75	1,101.12	1,040.75	999.73
Labor (family)	675.24	706.37	860.43	753.63
Others*	135.13	93.17	69.00	98.69
Total Expenses				
Per farm	5,364.43	5,387.19	5,489.47	5,412.61
Per hectare	2,996.89	2,707.13	3,210.22	2,957.71
Net Profit				
Per farm	1,861.82	3,140.61	3,231.83	2,723.04
Per hectare	1,040.12	1,578.20	1,889.96	1,488.00

*includes pay in kind and/or given free.

Impact on Income Distribution

The distribution of the shares of the benefit of the project is shown in Table 7. The average for all farms showed that 25 percent of the output went to the landlord, 27 percent to hired labor, 14 percent to current inputs, and 34 percent to the tenant.

Impact on Employment

The average amount of labor employed on all farms was 171.8 man-days per farm or 93.9 man-days per hectare (Table 8). High-irrigated farm labor employment totalled 175.2 man-days per farm. That is equal to 102.5 man-days per hectare. Low-irrigated farms registered a total employed labor of 160.6 man-days per farm, equal to 89.7 man-days per hectare.

VII. SUMMARY AND CONCLUSION

The Tapayan Communal Irrigation System has contributed directly to increased agricultural production, income growth, and

TABLE 7
AVERAGE DISTRIBUTION OF INCOME, 14 SHARE-TENANT PALAY PER HECTARE BARANGAY TAPAYAN, SULTAN KUDARAT, MAGUINDANAO 1981

Irrigated	*Number of farms*	*Income Shares (in pesos)*				
		Land-lord	*Share tenant*	*Hired-labor*	*Current inputs**	*Total*
Low	7	99.59 (25%)	1,158.36 (29%)	1,118.42 (28%)	718.98 (18%)	3,994.35 (100%)
Medium	4	1,118.42 (25%)	1,700.00 (38%)	1,163.16 (26%)	492.11 (11%)	4,473.69 (100%)
High	3	643.16 (25%)	841.58 (33%)	725.26 (28%)	355.79 (14%)	2,565.79 (100%)
Total or average	14	923.40	1,252.33	1,007.15	518.06	3,700.94
Percent		(25%)	(34%)	(27%)	(14%)	(100%)

*Includes seed, fertilizer and chemical.

farm employment. The data gathered to support this conclusion were based on the dry season period of 1981. In the analysis, three levels of farms were considered: high-, medium-, and low-irrigated farms. Comparisons on production, income and employment were made on these three levels. The project's primary benefit to the farmers is that farmers are able to get at least two crops of rice per year instead of one. Secondly, the project helps Tapayan farmers get higher yields during the wet season. Twenty-five percent of the total benefits went to the landlord, 34 percent to the share-tenant, and 27 percent to the hired laborers. On farm employment, analysis shows that high-irrigated farms employed more laborers than the low-irrigated farm.

TABLE 8
AVERAGE LABOR USED PER FARM BY OPERATION, 42 PALAY FARMS BARANGAY TAPAYAN, SULTAN KUDARAT, MAGUINDANAO, 1981

Operation	*Irrigated*			*Average*
	Man-days per farm			
	Low	*Medium*	*High*	*(all farms)*
Seed preparation and Sowing	4.4	3.8	3.2	3.8
Plowing	9.2	10.0	11.9	10.1
Harrowing	11.0	7.9	11.0	10.0
Pulling of seedlings	19.8	23.5	23.6	22.2
Transplanting	43.0	48.0	41.4	44.1
Weeding	9.7	10.0	14.6	11.4
Spraying	2.8	4.2	4.0	3.6
Fertilizing	1.9	2.4	2.1	2.2
Harvesting	47.0	57.7	52.5	52.3
Threshing*	11.8	13.6	10.9	12.1
Per farm	160.6	181.1	175.2	171.8
Per hectare	89.7	91.0	102.5	93.9

*Includes hauling.

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